POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

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Hauling Borax in the Hottest Place on Earth

Wierd Region in Death Valley, Far Below the Sea Level From Which Comes the Product that is Now Attracting the Attention of the World's Scientists--*See Page 215*

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SUITS A BUSY MAN.

I am enclosing you with this letter renewal for another year's subscription to Popular Mechanics.

No doubt you would like to know what your readers think of the little paper. I think it is the best paper of the kind I have ever taken. I have but little time to read, and your paper always has things right to the point and on all up-to-date subjects, and I always anxiously look for it. I take several papers of this nature, and I notice that you always have the new things out about a month or so before the others do. Yours very truly, Cy E. Anderson, dealer in footwear, Lincoln, Neb.

San Jose, Cal., offers to give $1,000,000 to secure the location of the California state capitol in that city.

LATEST AND GREATEST IN AUTOMOBILES—PART II.

New and Novel Conceptions That Have Recently Been Born in Paris

By Thornwell Hynes, United States Consul

Besides the new automobiles mentioned in my last contribution to Popular Mechanics, there are several other conceptions that are attracting considerable attention throughout the automobile world. A Paris firm recently made a 6½-horsepower machine with wooden frame and vertical supports. To this was attached a false frame upon which was placed the motor, the speed-changing gear and the carburetor. The motor had water circulation and gas regulator. Ignition was effected by means of accumulators and a coil without a trembler. The radiator was of the type usually employed with wings, fixed in front. The steering was done by a wheel, with endless screw, non-reversible. There were three metal brakes acting both ways, one on the differential and two on the wheels. This carriage on a level road carries four persons at 27 miles an hour and consumes six quarts of petroleum.

The carriage of one manufacturer was composed of four parts, totally distinct and easily accessible: First, the frame; second, the vertical motor in front; third, the speed boxes, with friction connection; fourth, the steering gear. The frame which is in the form of a rectangle made of wood covered with bent-steel springs, strengthened by steel tubes interlaced, supports the body and the springs. The mechanisms of propulsion and transmission were swung, cradle fashion, in a corner channel hanging from the frame, and resembled in form a baloon frame, being absolutely rigid in spite of its lightness. In front the frame rested on long steel springs over the steering gear, which was a new model, fitted with ball bearings and a double oil bath; behind, it rested on the axle tree of the drive wheels, attached to the frame by connecting rods so arranged that no accident could happen to the chains. The motor was driven by alcohol and was arranged on the front part of the frame. It was composed of either two or four vertical cylinders in one piece, with water jacket without any breach attached. The connecting rods, wimble and distribution cogs were enclosed in a carter case, with an oil bath, and sheltered from mud and dust. Cooling was accomplished by means of a turbine with automatic working, which sent a large quantity of water into a radiator fixed in front of the motor. In case of an accident to the pump the cooling of the water was insured by a thermo-siphon, owing to the position of the water reservoir. The motor was sparked by magneto-ignition.

The regulator acted on the automatic carburetor, maintaining the exact quantity of the mixture, regardless of the speed of the motor. The spray was distributed by a double current of air, thus avoiding condensation. By this, the expenditure can be reduced to a minimum and proportioned to the work required, suppressing thumping and enabling the machinery to move as slowly as desired.

All the parts of the mechanism are enclosed in a carter filled with oil. This carter had only one horizontal joint, by means of which the upper part could be removed in order to take out the shafts, cogs, gear connections and differential, without taking anything to pieces. The mechanism was composed of a longitudinal shaft carrying the connection cone; the latter was free on the shaft and provided with an arrangement to prevent slipping. It was moved by a pedal acting upon a ring of ball bearings, the contact being assured by a vertical spring which could be regulated while running. On the same shaft was attached the sliding train, which by its varying position transmitted the four speeds and the backward movement to the secondary shaft, which had a second connection cone that worked the differential shaft. The four speeds and the backward movement were controlled by one lever, to the right of the driver. All side movements in the shafts of the mechanism or the motor were prevented by the use of ball-bearing abutments. The steering gear sloped backwards and could not be reversed. It was adjustable and the wear and tear was reduced to a minimum by a shifting bolt between the screw and the sector.

Hungarian dentists and chemists claim to have discovered a valuable anaesthetic in alkaloid, nervocidine, the hydrochloride of which is stated to have similar properties to cocaine, but to produce a much more lasting anaesthesia.

New Field Gun a Masterly Achievement

Recoils on the Carriage So that it May Be Fired Rapidly Without Losing Its Position

A field gun which recoils on the carriage, preventing the carriage from moving a particle when the piece is fired, is regarded by army men as a masterly achievement in artillery construction. The illustrations show three guns at the instant of firing, and demonstrate very clearly their comparative efficiency. Fig. 1 is an old-time field gun with rigid trail spade. The effect of discharge is seen on the piece and the forward part of the carriage; the latter rears, that is to say it rises from the ground to fall back afterward more or less exactly in its initial position. The piece must be laid again after each round, which takes more or less time, depending on the greater or less loss of aim. The rapidity of the fire is diminished accordingly.

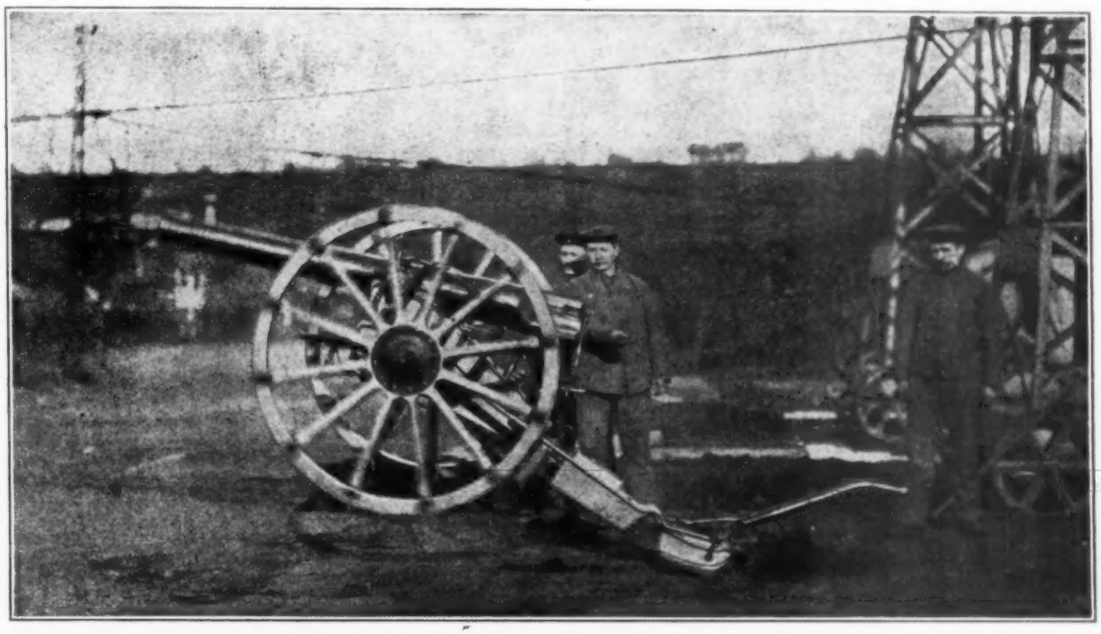

Fig. 1.—Field Gun Carriage with Rigid Spade, at Instant of Firing

An improvement on the rigid trail spade is shown in Fig. 2. This is a gun with an elastic trail spade. The spade at first inclined to the rear, biting into the earth, has rotated about a hinge-bolt, and the trail has recoiled a proportionate distance. Simultaneously the spade has compressed a column of springs placed between the cheeks of the carriage. The expansion of these springs then returns the piece to its first position. The smoothness and ease of working of the elastic trail spade is shown by the position of the third cannoneer, who can place himself immediately behind the trail without fear of being hurt by the recoil. It is no longer a question here of a "jump" of the piece. The move-

Fig. 2.—Field Gun Carriage with Elastic Spade, at Instant of Firing

ment is shown in the photograph by the blurred appearance of the wheels and carriage.

The result of the latest improvement—a field gun recoiling on the carriage—is shown in Fig. 3. In describing this gun the Journal of the United States Artillery, the great authority of the American army, says: The gunner is seen seated on a seat attached to the trail, from which position he manipulates the sighting apparatus, while the gun recoils. The gun passes by his right shoulder which is protected by a standard fixed to the cradle.

The lower carriage rests absolutely immovable so that the two other cannoneers can remain on their places immediately near the gun and behind the trail, as shown in the figure. This permits the repointing and reloading of the piece to be accomplished while the gun is returning "in battery." The interval between two rounds is determined, then, solely by the time necessary for recoil and the return into battery of the piece alone.

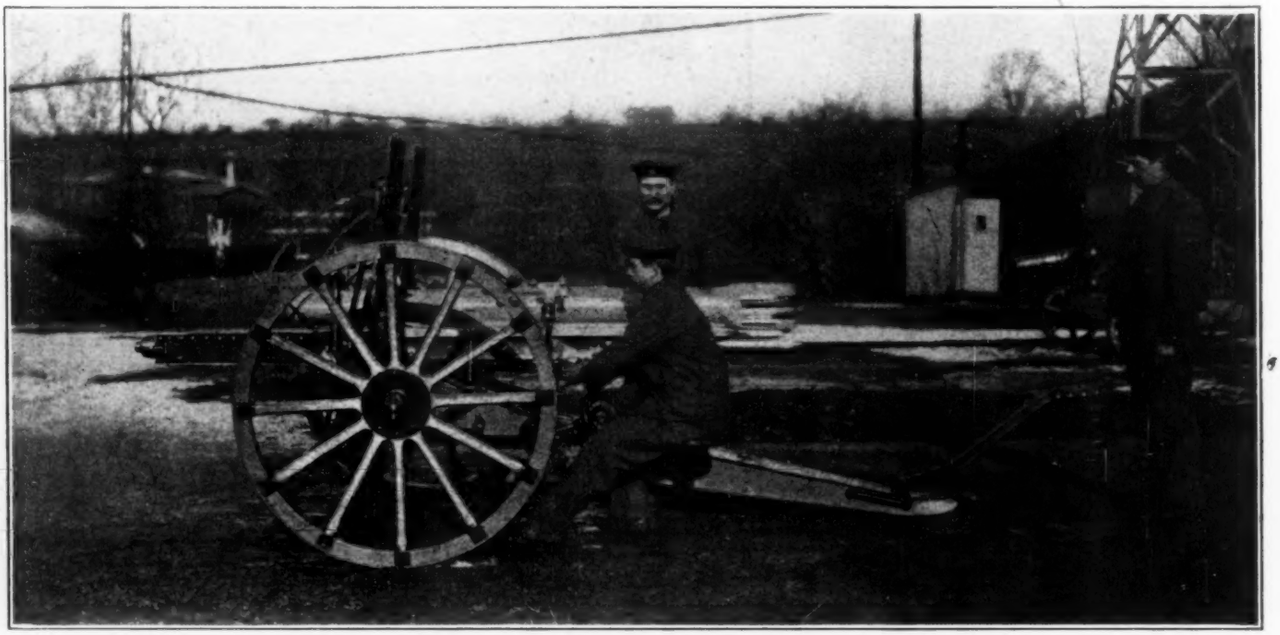

Fig. 3.—Field Gun with Recoil on Carriage, at Instant of Firing

THE FIRST WIRELESS NEWSPAPER.

Two Issues on the Steamer Etruria from Information by Marconi System

The steamship newspaper with wireless telegraph dispatches has come. The Cunard liner Etruria arriving at New York from Liverpool and Queenstown recently brought copies of the first issue of this remarkable journal. The ship was equipped with a complete newspaper printing outfit as well as a first-class wireless telegraph office. S. Harris, the ship's printer, performed the duties of publisher; Purser J. A. McCubbin acted as editor, and Assistant Purser H. D. Stainer was circulation manager. Two issues were printed on the trip, each numbering 500 copies. In both cases the edition was off the press at 2 o'clock a. m., and copies were before the passengers when they sat down to the breakfast table. The first issue was printed when the ship was 150 miles off the Irish coast from news received by wireless telegraph from the Marconi station at Crookhaven, Ireland.

STREET SWEEPINGS FOR FUEL.

In England the sweepings from the street are being utilized as fuel in some of the electric light plants belonging to the cities. To be successfully used the firebox must be of firebrick, which does not readily conduct the heat, and the burning should be continuous. The fuel value of this refuse averages about one-sixth that of coal. There is less dirt in the sweepings of English cities than in ours, owing to the better pavements and other conditions of street traffic.

Popular Mechanics is the inventor's medium.

GREATEST CATHEDRAL IN THE WESTERN WORLD.

Bewildering in Size and Grandeur Will be the New Episcopal Church Now Being Built in New York

No man living can even estimate what the cost of this structure will be. No man can foretell the years that its building will require. It is to be the greatest house of worship on the western continent, and maybe in the world, and the most magnificent building in America. It is the Cathedral of St. John the Divine that is now rearing its granite walls from Morningside Heights in New York. For ten years the work has been progressing steadfastly, incessantly; yet that which has been done seems pygmean when compared with the preponderous task that remains unfinished. It may require a century to complete it. Even the architects will not attempt to estimate the time required; so bewildering is the undertaking. It is to be the largest structure of its kind erected in any land since the dark ages, and may compare favorably with edifices that have been classed among the wonders of the world.

And the great structure throughout is to be as magnificent in construction as it is grand in size. Black and White of London estimates its total cost at $200,000,000, but after this has been spent probably $200,000,000 more will be required to carry out the new designs that are continually being formed that nothing may be omitted that will add to its greatness and grandeur. As magnificent as mind of man can contemplate is this structure to be and money is scarcely to be considered in the project. It is being built to endure for all time as a monument to American Episcopalianism. St. Peters at Rome, the greatest Catholic church now in existence, will be small in comparison to this. It could accommodate the entire seating capacity of St. Peters and then have room for 20,000 more persons, for the Cathedral of St. John the Divine will seat 70,000 people. The structure is to reach the imposing height of 450 feet. It will be 500 feet long and 460 feet broad and will have four semi-circular naves around the dome. To secure the necessary supply of stone the Cathedral authorities had to buy outright a big granite quarry in Westchester, county, New York, and has taken a 99 year lease on a limestone quarry in Minnesota.

Herewith find enclosed draft in payment for your paper for one year. I consider your paper of great value to our high school pupils. They watch with eagerness for its arrival each week. Its educational value is worth many times its cost.—George P. Hambrecht, city superintendent of schools. Grand Rapids, Wis.

Borax, a Strange Substance from a Strange Source

Death Valley and Other Weird Places are the Fields From Which it is Harvested

Borax Works in Mysterious Death Valley

In Death valley, California, far beneath the level of the sea, there is a great expense of crystalline crust covering a thick grayish slime, which extends to a depth that has never yet been explored. From this crystalline crust is produced borax, the product that is now attracting great attention in Germany and other European countries, because of its newly discovered properties. There are other places where borax is found and all of them are strange, weird places, barren and desolate. In California there are other "borax marshes" in Saline Valley in Inyo county and in San Bernardino county. The scummy marshes, which lie surrounded by desert hills, present from a distance the appearance of dirty melting snow. The heat in these marshes is intense, Death Valley having been declared to be the hottest place on earth.

Borax, which within itself is a mysterious substance, now puzzling the world's greatest chemists, comes from a source of mystery. Just as none knows the depth of these marshes, none knows how or whence they were formed. Some scientists say they are the bottom of prehistoric lakes, some that they are the craters of volcanoes of past ages.

Borax is now interesting because of the notoriety it has gained as a preservative. It is used in preference to salt to keep meat that is shipped abroad and Germany has interceded to prevent the further importation of such meat until it is determined as to whether the meat is injured by the treatment. Scientists disagree on the subject, but whichever is correct it is certain that by the borax treatment the meat is kept for weeks as fresh in appearance and taste as directly after it is butchered. But the uses of borax are many. It is employed as a flux in soldering metals, making enamels, fixing colors on porcelain, and as a soap. It was originally obtained from a lake in Thibet and was sent to Europe under the name of tincal.

Enterprise, a recognized authority on Pacific coast affairs, says: "Of all the many products of California, there is none which places her so effectively in the front rank as the comparatively unknown borax industry. Only by Asia Minor is she surpassed in the production of this commodity, and in no other industry has her output so emphatically affected market prices.

The greater part of the borax of commerce is made from borate of lime, in its most common form, known to mineralogists as "ulexite." Buried thickly in these marshes, it occurs in the shape of "cotton balls," which vary in size from a pebble to a boulder and take their name from the beautiful silky appearance of their interior when first broken. Borate of sodium also occurs in great abundance, but though more readily convertible, does not produce as high a grade of commercial borax as ulexite.

By means of teams or traction engines, the material is hauled by cartloads to the works, where it is first dumped into a powerful crusher, which reduces it to a lumpy form. Another finer crusher grinds it to a sand and finally it is converted by means of burrs and rollers and bolting through silk into a fine powder.

It is then mixed with a quantity of pulverized sal-soda, the mixture being put into boilers containing boiling water. By means of stirrers the contents are kept agitated to assure a perfect mixture of the mass.

Soon, by the action of the motion and the heat, the sal-soda gives up its carbonic acid, which unites with the lime and forms a precipitate of calcium carbonate, a useless by-product, which, being insoluble, remains in the bottom of the boiler. Meanwhile the boracic acid and soda combine, forming the borate of sodium, which is then drawn off in solution with the water and slowly crystallizes in wide, shallow vats, forming dark-colored crystals, known as "precipitates." When this process of crystallization has reached its limit, the remaining liquid is returned to the boilers and used again and again, until it becomes too full of impurities for further boiling.

The crystalline residue is borax, but in a state too impure for commercial use, so it is again dissolved and recrystallized several times, until sufficiently pure.

Where the borate is mined as tincal or in other crystalline forms, the process is simpler than that for ulexite, as above described. No chemical agent is necessary in that case, the crude material being merely dissolved and crystallized as often as may be required.

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PROTECTED SEARCH LIGHTS IN THE GERMAN NAVY.

Of all the modern improvements on board a man-of-war none would be missed so much as the searchlight. It is the eye with which the great battleship peers for miles into the darkness and sweeps the waters to discover those dangers which ever threaten even in times of peace. The importance of the light for use at night following an engagement can scarcely be estimated. And yet practically no provision has been made to protect the searchlights which are mounted upon the masts or other specially exposed positions. Germany alone of all the navies seems to have realized this danger, and in her latest

Protected Search Light

ships has placed the lights amidship with an armor screen to protect it. The Engineer of London doubts, however, if the German solution is a good one, as the lights to be really effective must be placed at a considerable height. The illustration shows a great German battleship with protected searchlight pouring a glare of light out from among her guns.

The Potato is Making Germany Rich

Alcohol From the Tuber Used for Engines, Motor Vehicles, Heating, Lighting and Cooking

By Frank H. Mason, United States Consul-General at Berlin, Germany

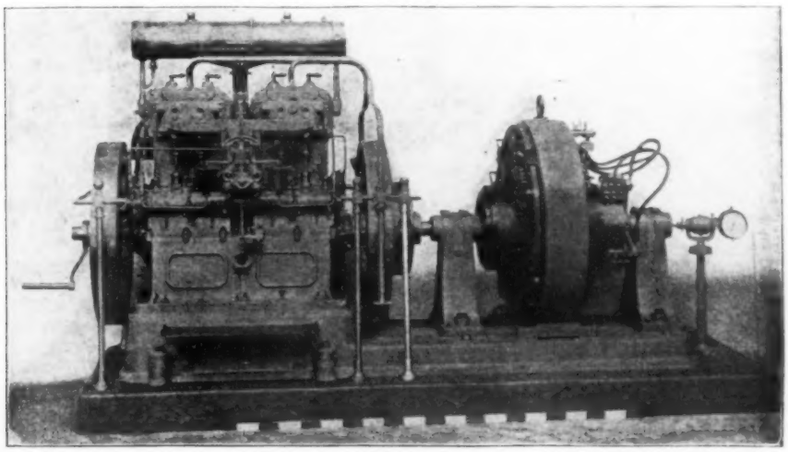
As a result of the abundance of land adapted to potato culture and the steady increase of product through consummate scientific methods, the potato crop of Germany in 1901 had reached the danger point of overproduction; that is to say, the harvest of 48,687,000 tons of potatoes raised the serious problem of how to dispose of them without waste or so depressing the market price that there would be left in it no profit for the farmer. The first result was a tremendous increase in the production of potato alcohol during the autumn and winter months, a consequent oversupply of raw spirits on the market, and the exposition of 1902 in Berlin to illustrate, promote and extend by all practical means the use of denaturalized alcohol for technical and industrial purposes. The exposition has been repeated this year on a broader and more comprehensive scale, in that it now covers not merely the alcohol industry, but the cultivation and the several principal uses of potatoes. The exposition confirms and reinforces the impression made by the display of 1902 that the law of 1887 governing the manufacture and use of untaxed alcohol for technical purposes was one of the wisest and most far-seeing enactments in the legislative record of the empire. For every dollar of direct revenue that was thus sacrificed the people have profited many fold from the stimulus thereby given to potato culture and the important uses of cheap alcohol in chemistry and the industrial arts. As a typical example that combines in the highest degree the latest progress in construction of spirit engines, there is given herewith a photograph of a 50-horse power alcohol engine invented by Director Boris Loutzky, of the Russian marine engineering service, and built by the Daimler Motor Company at Marienfelde. This was one of the most notable exhibits at the recent exposition and attracted the special attention of the German emperor, whose enthusiastic interest in all that relates to the use of alcohol for motor purposes on land and sea is well known.

It is perhaps less generally known that Russia is following in the same direction; that for two years past the navy of the czar has been using alcohol boat motors up to 300 horse power with highly succesful results. More recently the internal revenue tax has been removed from Russian alcohol when used for industrial purposes, and the government has adopted the definite policy of making the potato, through conversion into denaturalized spirits, a source of increased wealth to the peasantry. The engine is shown in the illustration coupled directly to a generator, but it may be used for marine or any factory purposes for which a motor of that size and horse power is adapted. Its efficiency will be inferred from the tests, which showed its alcohol consumption to vary from .67 to .75 quarts per horse power hour. At 650 revolutions per minute it developed about 61 horse power and ran with such steadiness that the difference between running light and with full load was only 3 per cent. This regulation is accomplished by means of a centrifugal regulator, which, by creating a vacuum in the cylinder in proportion to the power exerted by the motor, regulates the consumption of fuel. Like many other alcohol motors, this is started and warmed up with gasoline, and a lever changes the supply from gasoline to alcohol as soon as full speed has been attained. The ignition is by electric spark, and as a provision against all contingencies, both magneto-electric and accumulator currents are provided, and the former utilized by means of an inductor, the accumulator serving as a reserve in case the galvanic spark should fail. The moment of ignition, which is of great importance in explosion motors, can in this engine be adjusted to occur at the most advantageous part of the stroke, thus securing the maximum effect.

The department of lighting apparatus

includes a vast and varied display of lamps, chandeliers and street and corridor lights, in which alcohol vapor is burned like gas in a hooded flame covered by a Welsbach mantle. Under such conditions alcohol vapor burns with an incandescent flame which rivals the arc light in brilliance and requires to be shaded to adapt it to the endurance of the human eye.

Similarly attractive and interesting is the large display of alcohol heating stoves, which, for warming corridors, sleeping rooms and certain other locations, are highly esteemed. They are made of japanned iron plate in decorative forms, with concave copper reflectors, are readily portable, and when provided with chimney connections for the escape of the gases of combustion, furnish a clean, odorless and convenient apparatus.



50 - Horse Power Alcohol Engine

Cooking stoves of all sizes, forms and capacities, from the complete range, with baking and roasting ovens, broiler, etc., to the simple tea and coffee lamp, were displayed this year in endless variety.

In order to promote the substitution of spirit motors for steam and horse power, it was necessary to make alcohol cheap and easy to obtain by farmers in districts where no raw spirit is made. To meet this requirement, the Central Association undertakes to deliver free at any railroad station in Germany denaturalized alcohol of 90 per cent purity, in quantities of 67 to 75 gallons, for approximately 15, 16 and 17 cents per gallon, according to the material with which it is denaturalized. As the consumption of a modern alcohol motor for farming purposes is about ¾ quart (costing about 2 cents) per horse power hour, it will be apparent that in this country at least benzine and petroleum have met a serious competitor as fuel for motor purposes. The Hamburg-American Steamship Company has in service a harbor-inspection launch which, with a 23-horse power spirit engine, makes a speed of 10 knots, and preparations are being made to greatly extend the use of such motors in the launches and ships' boats of the German navy.

It has been definitely decided, with Chicago's consent, to hold the Olympian games in St. Louis in 1904 instead of in Chicago.

The new long distance telephone line connecting Paris and Rome is 956 miles in length, and the longest in Europe.

Girls Make This Road Pay

Pretty Japanese Maids Delight Pilgrims and Tourists on Their Way to Holy Kompira

Feasting and drinking in the presence of the "cutest" girls in Japan on a railroad whose mission is to transport worshipful pilgrims to the holy shrine of Kompira is one of the novelties of life in Japan. This railroad, called the Sanuki line, is a delight to the tourist and seemingly not distasteful to the pilgrim. It is a narrow gage line just 27 miles long, running from Takamatsu on the coast to sacred Kompira. It is also known as the Holy railroad. The principal feature of the passenger trains are the delightful dining cars, artistically decorated with tables spread with all the dainties of dainty Japan. But the daintiest of all are the petite waitresses. With little rosebud mouths and melanecomous tresses they bend pleasingly over the table and gaze with the most mischievous eyes while receiving orders. It generally takes the guests a long time to peruse the menu and there is little doing on this "Holy road" outside of the dining car.

These girls were selected from numerous applicants and each had to possess these specified qualifications: winsome personal appearance; some education; good health; good conduct; no "past,"—for even in Japan there are women with a "past." They are required to dress their hair in the agemaki style, which resembles a Greek helmet; they must wear a kimono, minus the long sweeping sleeves While on duty they must behave with military discipline, take no tips and refrain from chatting with the guests. This railroad pays 25 per cent a year to its shareholders.

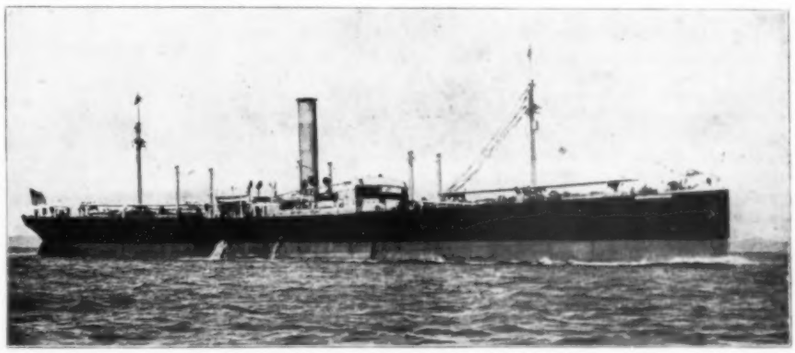
CAN'T EAT SNAKES IN KANSAS.

An anti-snake eating bill has passed the Kansas legislature and hereafter it will be a misdemeanor for a hotel, restaurant or eating house to serve, and for the guests to eat, snakes, lizards, scorpions, centipedes, tarantulas and other reptiles, says the Hotel World. What prohibition Kansas now needs in addition to this law and Carrie Nation is an anti-snake seeing statute.

Largest Freighter on the Pacific

Mammoth Merchant Vessel, the Arizonian, Goes into Service

The latest commercial product of the wedding of the Pacific coast to the islands of the eastern seas is a monster freight steamship vessel, born in San Francisco, and christianed the Arizonian. This new ship, which has just ventured from its cradle at the Union Iron Works docks, is the largest mechant vessel ever built on the Pacific coast. She has a gross tonnage of 8,671 tons, and 5,621 net. Her carrying capacity is 11,000 tons. Her dimensions are: Length over all, 486 2-5 feet; length between perpendiculars, 469 feet; beam, 57 feet; molded depth, 35 feet; draught, 28 feet. The freighter is driven by quadruple engines with cylinders 21 2-5, 28, 38 and 60 inches respectively, and stroke of 30 inches. At 240 pounds pressure the engines will develop 3,000 horsepower.



Freighter Arizonian, Largest Merchant Vessel on the Pacific

The Arizonian belongs to the American-Hawaiian Steamship Company, and is a member of that family of great freight steamers to which belong the Texas and Alaskan.

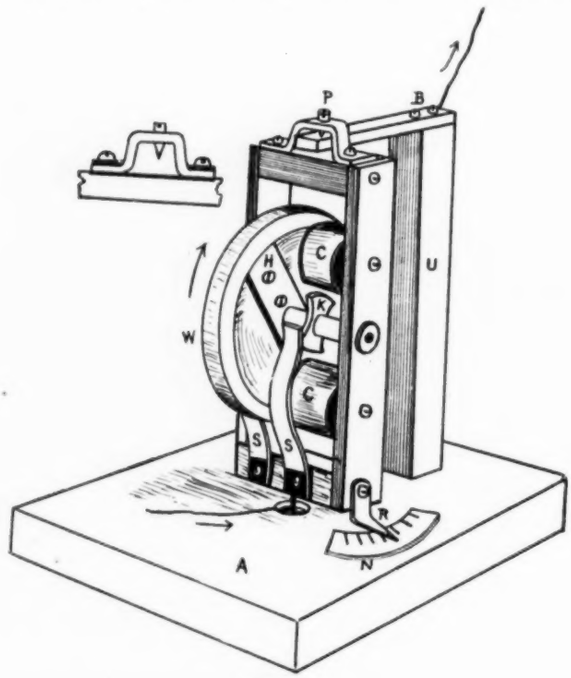
The Arizonian is to go to Hawaii on her maiden trip. Later she will go into the Sandwich Islands trade, and will make both Pacific and Atlantic ports.

Easy Electrical Experiments

By L. P. Dickinson

HOW TO MAKE A GYROSCOPE.—III.

The rotating and the fixed parts of our instrument having been completed, they can be assembled together after the manner indicated in the figure below. It will be seen that the wheel W is mounted so as to swing freely in the center of the frame, already constructed. It is essential that this wheel should run very smoothly and evenly and should be perfectly balanced. The iron armatures fastened to its sides should pass very close to the poles of the electro magnets C,



Gyroscope

of which there are two on each side of the wheel, without touching the latter. For this reason the wheel can have hardly any side motion. The strip of brass into which the pivot P is fastened must be insulated from the frame. To accomplish this strips of hard rubber are placed between it and the frame and also under the head of the screws which clamp it, the latter being provided as well with an insulating bushing.

At the bottom of the frame are attached two springs, marked S, which are also insulated from the metal frame, but are connected with each other and to a piece of wire hanging from the bottom of the frame to a distance of about one inch. The four coils are connected in series in the manner previously described, and one terminal of the wire is connected to the insulated pivot P. The other terminal of the coils is connected to some part of the metal frame.

A suitable base, shown in the figure, is provided with an upright post U, which carries at the upper end the heavy strip of brass B. The height of this post should be such as to allow the frame to swing clear of the base by about ½ inch. Directly under the middle of the frame a hole is to be bored in the base to a depth of ½ inch, into which is to be poured a globule of mercury. The projecting wire already mentioned should dip into this mercury when the frame is suspended in position. The pivot P should be very sharp and hard and should bear upon a piece of hardened steel fastened to the brass strips B so that the gyroscope may turn with very little friction into any position.

Its action is as follows: Current is led into the lower mercury cup by a wire as indicated, thence to the insulated springs S, to the contact maker K, to the frame of the machine, through the coils C to the pivot P, and thence out of the wire shown at B. The action of the contact maker K is as follows: When the iron strip H is ⅛ of a revolution from the poles of C, K should make contact with S, closing the electric circuit through C, which causes H to be attracted. This should continue until H is exactly opposite to the poles, when the contact should be broken. Now for ⅛ of a revolution the circuit will be open, but after this interval the strip on opposite side of the wheel should be ⅛ of a revolution from the magnets on that side. The contact maker on that side should now close the circuit and act in just the manner that K acts when it comes in contact with S. If three or four strong bichromate cells be used, the wheel ought to revolve at a high rate of speed.

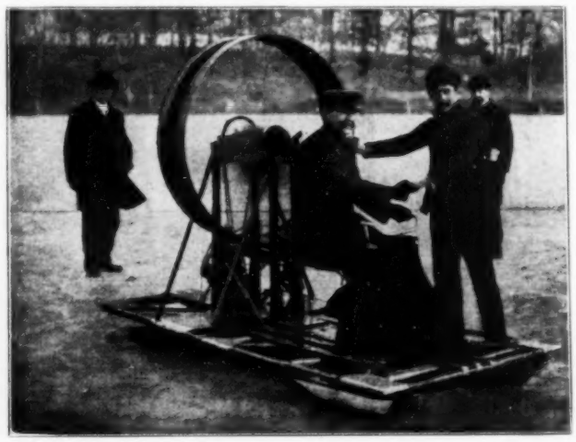
Its gyroscopic action—that is, its resistance to any change in the plane of its rotation—is very marked. If no force were acting on the wheel, it would be impossible for it when once started to change the plane of its rotation. If the pivot P be without friction, the base may be turned about in any direction without altering the position of the wheel H. Suppose the wheel to be started so that its plane points exactly north and south. It will continue to run in the direction in which it is pointed, even though the base A and the earth under A should change their position. Now the earth is constantly rotating, and what is north for a person in one place is not north for a person in another place, for the reason that the meridians of longitude converge at the pole and are therefore not parallel. If the wheel be started to rotating in a north and south meridian at a given time, it does not mean that the wheel will continue on this same meridian, but it will always continue to rotate towards some fixed point in space. After a time, therefore, the wheel will apparently have changed its direction of motion and will no longer point north and south. It is not the wheel which has changed, however, but the earth. By making a small sphere and drawing lines upon it to represent the meridians, it will be very easy to understand this matter. Of course, it is understood that the force of gravity will make the wheel to always rotate in a plane passing through the center of the earth, but this can in no wise affect the horizontal direction in which the wheel points.

Note.—In Chapter I the contact strips were erroneously described as having an arc of contact of ¼ revolution. They should close the circuit for only ⅛ of a revolution at a time.

QUEER WIND-WHEEL ICE BOAT.

Operated by an Air Motor Which Is Under the Absolute Control of the Steersman

Going either with or against the wind, turning to the right or left, slowing down or going full speed, all at the will of the steersman, a new ice boat, operated by a novel air propeller, the invention of J. Bruce Macduff, of Brooklyn, N. Y., promises a new source of amusement and commercial use in northern climes. The first model of the device carried six persons and made a speed of 15 miles an hour. The perfected machine is expected to skim over the ice with a speed of 120 miles an hour. The air propeller is the feature



Sled Driven by Air Propeller

of the boat. It is a wheel based on the principle of the marine propeller and equipped with four blades. The blades are inclosed at the periphery by a flat band of their own width riveted to them. The propeller is 4 feet in diameter and is mounted on a frame above the gasoline motor, which is a 2¾ horse power connected with the propeller by sprocket and chain.

A SHIP WITHOUT A FLAG.

Rebuilt Vessel has Lost Her Nationality and has no Port to Call Her Own

Forbidden to carry a cargo, to officer or man the ship, or to use her own engines to propel her, because she is a ship without a flag or a port to call her own, the former Norwegian tramp steamer Hero recently left port in Baltimore in tow of a wrecking tug for New York. The vessel was rebuilt in Baltimore from stem to stern and keel to truck, at a cost of $80,000, and is as good as new, having a capacity of 3,500 tons of cargo and a speed of ten knots, yet the Navigation Laws of the United States say that she cannot be registered as an American ship, and as she lost her Norwegian registry she is a ship without a country.

As she has no official existence under any flag, she could not move from her dock without violating the laws of navigation, hence she had to be towed to New York by the Rescue without even dignity of being a barge. Her situation is most unique.

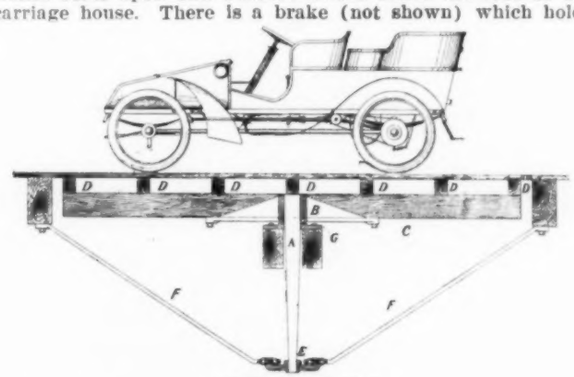
The Hero was a vessel 322 feet long, 40 feet wide and 29½ feet depth of hold, registering 1,779 tons net, that hailed from Bergen, Norway. She came to Baltimore in 1901 as a Norwegian steamer, and loaded a full cargo of coal for Colon, Central America. On the voyage she was caught in a norther and blown ashore off Colon. The owners abandoned her to the insurance companies, who, in turn, abandoned her to the Merritt & Chapman Wrecking Company of Baltimore. During these transaction her Norwegian papers were carried off and she lost her nationality.

The wrecking company succeeded in floating the vessel and towing her to New York. Later she was brought to Baltimore to be rebuilt by the Baltimore Drydock Company.

HOW TO MAKE A TURNTABLE FOR AUTOS.

It is very desirable to enter and leave the building where your machine is kept, with the forward movement, but to do this there must be room within to turn around, or else turn on a turntable. A writer in the Automobile thus describes how to make a turntable, which, of course, is just as convenient for turning any other vehicle.

In the accompanying sketch A is a tapered steel shaft which has a heavy, four-arm, iron spider, B, rigidly secured to its upper end. Across the extended arms of the spider are two timbers, only one of which, C, is shown in this view. Across these main timbers are fastened seven cross beams, D, upon which the floor is laid. The lower end of shaft A turns in an adjustable bearing, E, which is held in place by four heavy braces, F. These braces are bolted to the stationary timbers which surround the turntable. The entire weight is carried by eighteen large steel balls, which are placed between the hub of spider, B, and a bearing plate, G, which rests upon two timbers bolted under the sills of the carriage house. There is a brake (not shown) which holds



Automobile Turntable

the turntable against turning when for any reason it should remain as a stationary part of the floor. The device is entirely noiseless and may be revolved, automobile and all, with a force of a few ounces.

The stealing of coal from cars since the beginning of the high price of the fuel has caused an enormous loss to all coal-carrying railroads. A representative of the Burlington says: "Our road alone is robbed of coal valued at $1,200 each week. The loss for a year can be estimated at more than $50,000."

SENATOR FLOOD'S ODD AUTO-SLEIGH.

Combination of Wheels and Runners on Automobile Produces a Delightful Gliding Effect

Michigan may boast of a motor sleigh, designed by Senator J. K. Flood, which solves the propulsion problem in a novel manner, says the Automobile. Reasoning that a propulsion wheel would necessarily have somewhat the same effect on the motion of the vehicle as the ordinary rear driving wheels of an automobile, the senator simply leaves the rear wheels on his automobile, reduces the inflation of the tires and jacks the rear portion of the vehicle up on a pair of runners close inside of the wheels and on a special pair of springs, in such manner that a load in the vehicle bearing down on the runner

Senator J. K. Flood of Michigan in his Auto-Sleigh

springs forces the runners to the ground on a level with the wheel tires, leaving most of the weight on the latter. The soft inflation of the tires compensates for inequalities, and it is stated that the driving effect is quite sufficient, though offhand it would seem doubtful if the arrangement would be adapted for hill climbing.

The front wheels of the automobile are, of course, replaced with runners, which are pivoted in the usual manner for steering purposes, and the gliding effect of sleigh motion is said to be obtained perfectly by this combination of wheel and runners in the rear and runners alone in front.

DELAY IN PRODUCING THE EDISON BATTERY.

Promised in January and Not Ready Yet

The much heralded Edison storage battery, which was to place electric automobiles within the means of the laboring man and clerk, cannot be purchased yet. They were promised for January, but cannot be bought now, and the Chicago representative of the company declines to name any date at which they will be on sale. Mr. Edison is quoted as saying:

"The experimenting with the new battery has all been done, and the only thing that remains is to adapt them to the use of the public.

"These batteries are for public use and not for experts, and before they are put on the market I intend that they shall be adapted to the use of the most ignorant and most careless persons.

"They can be charged as quickly as anyone desires; in fact, they will meet every condition required. A most valuable feature of the new cells will be their rapid rate of discharge, which will give a very large amount of power in any emergency; this will be a particularly great advantage to hill climbing in bad weather or on a poor road. The cost of charging, of course, is a small matter. The cost of running an ordinary electric vehicle, including the services of a man, a boy, repairs, etc., is about $4 a day, of which the cost of charging is only about 23 cents."

There are 558 miles of electric railway lines in Canada, representing a capital investment of $41,593,063.

Popular Mechanics is "written so you can understand it."

SHOP NOTES

HOW MOLDS ARE MADE FOR ELECTRO TYPING.

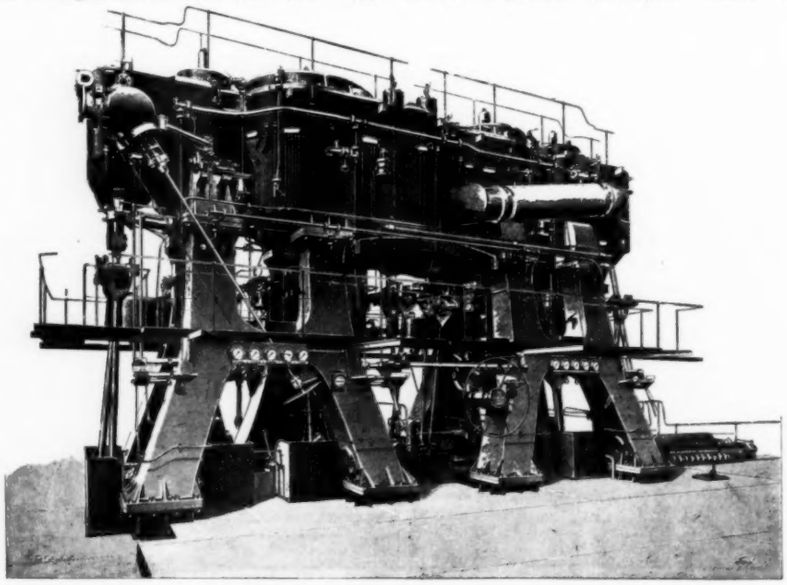
The molds are made of fusible alloy, plaster of paris, gutta-percha or wax. For making molds of gutta-percha the object to be copied is fitted with a metallic rim or is placed face up in the bottom of a metallic dish with a rim; the gutta-percha is then heated in boiling water until pliable, and placed in the dish in sufficient quantity to more than fill the dish; the whole is then placed under a press, such as a common letter press, and kept under pressure until quite cold and hard. For making molds in wax, says the American Electrician, the article is brushed over with sweet oil or boiled linseed oil, the excess oil being carefully wiped off with cotton; the article is laid on a smooth surface and is surrounded by a rim of card or metal standing about a quarter of inch higher than the highest point on the article; beeswax containing about one ounce of dry white lead to a pound of wax is then melted and allowed to cool almost to the point of setting; it is then poured carefully over the object so as to avoid air bubbles; as soon as the wax has set, the rim is removed and the wax-covered article is allowed to cool; when cold, the wax cast is easily removed, unless the wax was poured too hot, or unless the article was not sufficiently oiled. An excellent composition for molds is a mixture of two parts of gutta-percha and one of lard, the mixture being melted and used like wax. Plaster of paris molds are made by sprinkling the finest plaster into water until it becomes as thick as cream; a thin layer of this is carefully brushed over the object (which has been previously oiled) and then the rest of the plaster is poured on so as to form a mold of suitable thickness; in about an hour it will be set, and can be removed; the cast must then be slowly and thoroughly dried and the plaster saturated with metal paraffin wax to make it waterproof. Casts may be made of some easily fusible metal, such as Wood's metal, composed of four parts by weight of bismuth, two of lead, one of tin and one of cadmium, an alloy which melts at 140 deg. Fahr.; this is melted and poured over the object, which should be coated with a film of oil. Molds of metal, plaster and wax are suitable only for objects which are not undercut, and from which the cast may be removed without bending; gutta-percha will bend and stretch to some extent, and may be used on objects slightly undercut. For objects in high relief, or considerably undercut, a mold may be made of common glue, softened by soaking in cold water, and then melted with about one-fourth of its weight of treacle, with 2 per cent of tannin. None of the molds made as indicated above, except that of metal, is a conductor of electricity, and all such must therefore be given a conducting surface before use.

The most common method is to fasten a copper wire around the edge of the mold and then carefully cover the surface with a smooth coating of powdered plumbago by means of a fine, soft brush. The plumbago then makes a conducting path for the copper wire to every part which is to be coated with metal. When the mold is of a fusible metal it is necessary to cover the surface with a thin film of oil, or to allow it to tarnish slightly, so that the electrotype will not adhere too strongly.

The mold, prepared as indicated above, is suspended in a solution of copper sulphate, made by dissolving 1½ lbs. of crystallized copper sulphate in 1 gal of water, to which ½ lb. of sulphuric acid is added. The copper wire on the mold is connected with the positive (copper or carbon) terminal of a battery giving one or two volts. A copper plate is placed in the solution facing the mold and is connected with the negative or zinc terminal of the battery. Current is then allowed to flow for several hours at a rate not exceeding 10 amperes per square foot, when a thin coating of copper will be found deposited on the face of the mold. When the coating is of sufficient thickness, the whole is removed from the bath and the mold separated from the electrically-deposited shell. If the copper plate is a copy of a cut or half tone used for printing, the shell is filled with a backing of type metal, which is dressed to the proper thickness, and the whole is mounted on a block. When the same copy is to be used in a number of different places electrotypes are made from the original type or form and these electrotypes are sent to the various places.

BIG ENGINES FOR AUSTRALIAN LINER.

The new mail steamer Orontes, which is now going into service between England and Australia, is 630 feet long, and has a displacement of 15,450 tons. She has 10,000 horse power consisting of two quadruple expansion units of 5,000 horse power each. One of these we illustrate. The Engineer, London, says: The engines are of 5,000 horse power each. They are of the quadruple-expansion type, having cylinders 27¼ in., 39 in., 56 in., and 80 in. in diameter, by 60 in. stroke. They are supplied with steam by six steel cylindrical boilers working at a pressure of 215 lbs. per square inch. The cylinders are arranged in the following order: High-pressure, forward, low-pressure, second intermediate, first intermediate. The two forward cranks are at right angles to each other, and the two after cranks are also at right angles to each other; but the engines, being balanced on the Yarrow, Schlick, and Tweedy system, the forward pair is not at right angles to the after pair, but at an intermediate angle arrived at by calculation. The two smaller cylinders have piston valves, and the second intermediate and low have flat valves, with Joy's assistant cylinders. The valve gear is, as the illustration shows, an ordinary link motion. These engines were built by the Fairfield Shipbuilding and Engineering Company, Limited, of Glasgow, from whose yard the vessel was launched.



5,000 Horse-power Quadruple Expansion Engine of the Orient-Pacific Liner Orontes.

ACETYLENE RENDERED HARMLESS.

By a recent invention it is believed that acetylene can be used for public and private illumination without any danger, even if the gas be subjected to the test of an electric spark, says the Keystone. To obtain this result the storage cylinder is packed with asbestos or brick disks—the latter of eighty per cent porosity and filled with acetone. The acetylene is then pumped into the cylinder or tank under a pressure of ten atmospheres. It is found that the acetone dissolves or absorbs the acetylene to the extent of a hundred-fold the mathematical capacity of the cylinder. The gas is now being used on several railroads in this manner for illuminating purposes.

From January to November, 1900, France exported $1,351,000 worth of automobiles; during the corresponding period of 1901 the amount was $2,895,000, and for the same period of last year, $5,790,000. At the recent exposition, there were 200 more exhibitors than last year. One house alone is engaged in furnishing 150 automobiles for the United States.

The steel works belonging to the Japanese government, situated near Wakamatsu in the Prefecture of Fukuoka, cover more than 200 acres.

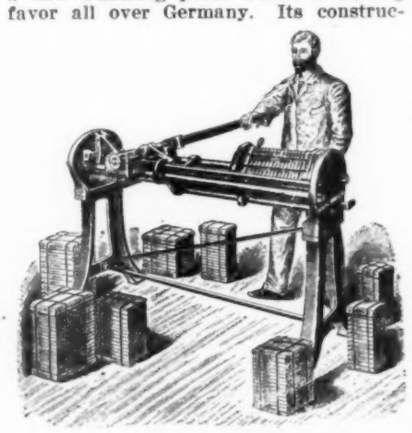
CARBORUNDUM TO LINE FURNACES

Affords Protection From Most Powerful Heat and Is Easily Applied.

A new and interesting use has been discovered for carborundum, which has already found large employment as a substitute for emery in all cases where a specially hard abrasive is required. Being capable of preparation only in a powerful electric furnace, where silica and carbon are fused together in presence of sawdust and common salt, carborundum is highly refractory; and it has been observed that a thin layer of the same substance applied to any other material of which furnaces are usually constructed, protects it from the heat and renders it almost equally refractory. Finely powdered carborundum is made up into a paste with water-glass, that is, sodium silicate, or some similar binding substance; and the paste is applied by means of a brush or otherwise to the bricks which are intended to be used for binding a furnace, or those bricks are actually immersed in the viscid liquid for a certain time. If the furnace has already been built the paste can be painted on to the exposed surfaces, giving one or more coats as may be desired. It is stated that a layer, less than a twelfth of an inch thick will protect the bricks from the attack of the highest temperature produced by the combustion methods in ordinary work. Examination of the bricks in such a furnace after it had been pulled down showed that they had not suffered in the least. The skin of the carborundum does not chip off and is hard enough to resist mechanical injury.

LATEST BUNDLING PRESS IN GERMANY.

The accompanying illustration shows a new bundling press which is finding favor all over Germany. Its construc-



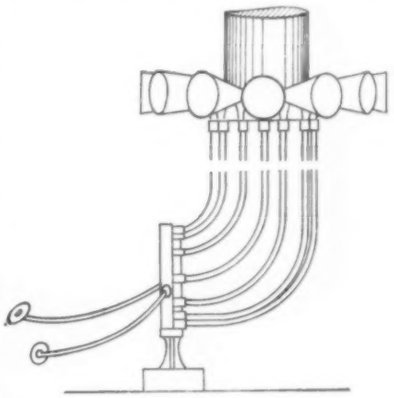
New German Bundling Press

tion is entirely of iron and it is manufactured by the firm of Karl Krause, Leipzig. The machine is solidly built, and ties and packs books, manuscripts, etc., simultaneously, writes E. L. Harris, U. S. Commercial agent at Eibenstock. The workman in charge is able to control the pressure by means of a lever. The action of the gearing on this press is so easy that one man without exertion can effect the highest admissible pressure. The platens are provided with grooves to permit the stringing of books, etc., while pressing them.

The Edam Fog Signal

The Edam fog signal is the invention of E. de Muelemeester, of Brussels, Belgium, and indicates the direction from which signals are being sent in a fog. Anyone who has been on board ship during a heavy fog knows how extremely difficult it is to determine the direction from which come the signals of other vessels or warning stations. One person is certain the sound comes from the north, but others will be just as sure it is from the east or west.

The Edam device consists of a circle of trumpets mounted on a mast, the bells of the trumpets covering the complete horizon, by means of the mechanism at his hand he closes all the acoustic tubes passing from the receiver to the indicator, except the one in front of the index needle. If then he hears nothing, it signifies that the sound does not proceed from the direction toward which the bell of the trumpet, corresponding to the open tube, is turned. He then places the index between two tubes (by which means all the tubes are opened again) and notices whether the sound continues, after which he sets the index at the following number, and so on till he discovers the



Indicator Which Locates the Direction of the Fog Signal.

circle. From the small end of each trumpet a tube connects to the receiving machine, from which two tubes lead to the ears of the operator. By shifting the controller around the operator receives the sound from only one trumpet at a time. The one which gives the clearest sound shows the signal to come from the direction in which the trumpet is pointing.

Geo. W. Roosevelt, U. S. Consul at Brussels, says: When the operator hears a sound coming from some point of the exact direction of the sound. The whole proceeding takes a few seconds. Experiments have been made in the North Sea with two steamers, one furnished with the fog signal and the other without it. The last was ordered to give signals with its siren, maneuvering now at port, now at starboard, passing in front and behind the other steamer. The operator of the first ship could always indicate the position of the other ship in a few seconds by means of the indicator's needle, and follow the alterations of its course.

POINTS FOR AMATEUR ELECTRICIANS.

By E. W. Hurst, Secretary and General Manager of the Farr Telephone and Construction Company.

For beginners in the study of electricity here are a few points that will be found worth remembering:

Electric Current—Magnetism, motion heat, chemical changes, etc., are said to be due to electric current.

Strength of Current—This is measured by the magnitude of the effects produced in a certain time.

Resistance—All bodies offer some resistance which is found to be in proportion to length of any material of uniform section and quality. Resistance varies with the temperature of the material. Metallic bodies increase with a rise of temperature.

Conductivity——Substances such as the metals which offer the least resistance are called good conductors.

Insulators.—Glass and gutta percha offer an immense resistance to the passage of electric current.

Volt—Difference of Potential or Electric M. F. The Leclanche cell has E. M. 1.46 volts.

The Ohm—Is the unit in which all measurements are expressed.

Ampere—The unit strength of current is called the ampere; equal to a current sent through resistance of one ohm by E. N. I. F. of one volt.

Circuit—The path through which a generator of electricity sends a current. It always forms a closed loop.

Earth—For economy the earth is often used to complete a circuit for a telephone connection in order to save a second wire.

Metallic Circuit—Is meant a circuit which the earth does not form a part, being made wholly of metal.

Induction Coils—Are made by winding over an electro-magnet coil, another coil of fine wire, with a large number of turns.

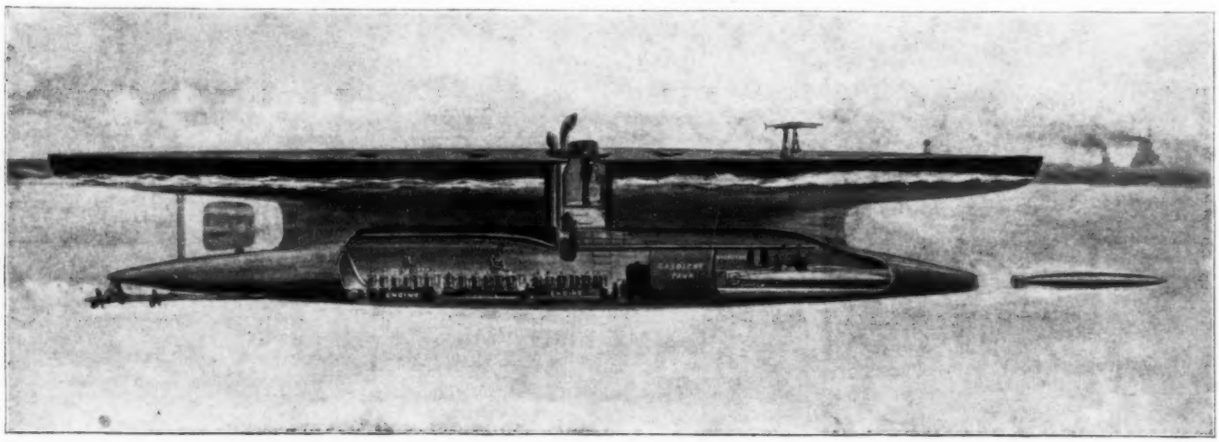
Wheatstone Bridge—Is one of the most generally useful testing instruments. Its cost is from $75 to $100.

The coal industry of Mexico does not seem likely to develop greatly on account of the inferior quality of the coal at present obtained and the demand is becoming very great in consequence.

Most Formidable Craft in the World

Sub-Surface Torpedo Boat, an Exclusively American Weapon, that May Prove the Terror of Navies

While the great navies of the world are being increased by the construction of vast floating masses of steel this country is quietly preparing a defense insignificant and harmless in appearance but possessed of fearful possibilities. A bill now before Congress provides for the immediate construction of not less than six new type torpedo boats which will cost $200,000 each. While submarine torpedo boats have given some remarkable tests, they have revealed the startling fact that the crew which operates them are in greater danger of their lives than the enemy they seek to destroy. These boats are far from satisfactory for many reasons, and this has led to the invention by an American, Clarence L. Burger, of an entirely new type which he calls the sub-surface torpedo boat. This strange vessel is so nearly under water as to be protected and practically invisible, but is never cut off from a constant supply of fresh air.



Sub-Surface Torpedo Boat.

A year ago Admiral Melville said: "It is in the direction of the semi-submerged boat that we must look for a dangerous weapon, and we must keep our eyes open to the fact," while another prominent expert says, "the semi-submerged boat is the coming boat for offensive work with the automobile torpedo."

The American Shipbuilder says of the new craft: The sub-surface torpedo boat consists simply of a cigar-shaped steel underwater hull holding the machinery torpedoes, torpedo tube, and other vitals and the crew safe from gun-fire, suspended by a hollow fin-like structure, from a distinct steel surface hull filled with cellulose, acting as a mere float to give vision, ventilation, buoyancy, and seaworthiness like an ordinary boat. By the separation of the two hulls, not only are the lower hull and vitals placed well out of reach of shells, but the displacement is halved, so that the necessary speed can be obtained, and the upper hull made low and almost invisible at a distance. A heavily armored conning tower rises from the lower hull through the hollow fin slightly above the surface hull. This armored conning tower in which the navigator stands and steers the boat, is proof against all small guns and is too small a target, in motion, for large guns to hit. Air is continually supplied to the lower hull through the armored conning tower by means of an ordinary blower, so that the ventilation is ample and gas engines are enabled to be used, by which the requisite power is obtained to drive the boat at 16 knots. A much higher speed could be obtained with a larger boat at some sacrifice of invisibility and maneuvering ability; but this speed is deemed by naval experts ample for the service for which the boat is designed, as enabling the boat to overtake fighting ships when maneuvering. In ordinary weather the upper deck can be used for exercise like an ordinary torpedo boat. The sub-surface torpedo boat being thus barely visible and almost invulnerable to gun-fire, and having a tested speed so much in excess of the ordinary maneuvering speed of fighting ships in battle or on blockade, it is fairly evident that, under cover of darkness, fog, or confusion of battle, and even in daylight, a squadron of these boats could generally be able to get within torpedo range—500 to 1,000 yards, and torpedo an attacking or blockading squadron, and get away again without being put out of action. Following are the dimensions: Length over all, 105 ft. 5 ins.; length of submerged hull, 94 ft. 3 ins.; beam of surface hull, 9 ft. 7 ins.; beam of submerged hull, 7 ft. 4 ins.; beam of middle hull, 2 ft. 6 ins.; draught, loaded, 12 ft. 10½ ins.; displacement, loaded, 101 tons; armor on conning tower, 4½ ins. thick; 6 gas engines, total horse power, 1,050; 2 shafts, 2 screws on each shaft, 1 torpedo tube, fixed telescope, 4 long Whitehead torpedoes, radius of action at 8 knots, 1,000 miles; radius of action at 16 knots, 200 miles, complement, 1 officer, 10 men.

INVENTS A CLEVER FROG CAGE.

Francis Bergstrom of Minneapolis has invented and just obtained a patent for something entirely new and novel in the way of a frog cage. It is in the form of a cylinder, about fifteen inches long and having a diameter of four and a half inches. The cylinder is of galvanized iron screen or bar, with meshes as fine as in mosquito bar. Each end is of wood, and in one there is a hole two inches in diameter, which is covered with a small mosquito bar net attached to a circular wire spring which opens easily and closes automatically.

The cage is designed to be carried on the back suspended over one shoulder with a cord. When the fisherman wants a frog he swings the cylinder in front of himself and shakes one frog into the small net covering the hole at one end of the cylinder. He then pinches up the net and holds the frog therein with one hand while with the other he opens the spring and takes it out.

This cage will appeal to fishermen because of the great convenience of having the frogs right with one all the time. To those who fish in streams from the banks and are constantly walking about it will be especially valuable, though perhaps not less so to those who stand in a boat casting.

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Transmission Gears, Running Gears, Wheels, Axles, Differential Gears, Coils, Batteries, and in fact everything necessary for automobiles, also caps, coats and all accessories

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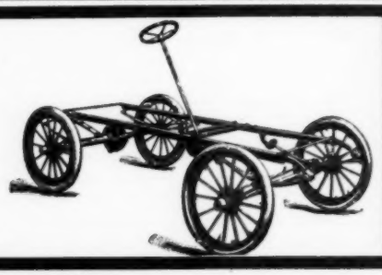

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TIDDLE-IDDLE-IDDLE-IDDLE-BUM-BUM!

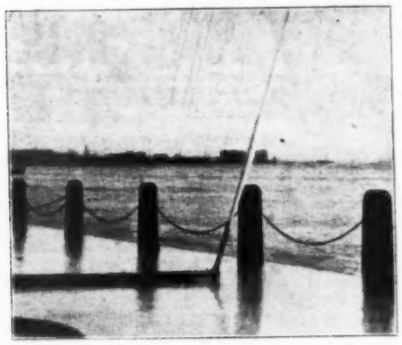
When our town band gets on the square
On concert night you'll find me there.
I'm right beside Elijah Plumb,
Who plays th' cymbals an' bass drum;
An' next to him is Henry Dunn,
Who taps the little tenor one.
I like to hear our town band play,
But, best it does, I want to say,
Is when they tell a tune's to come
With
"Tiddle-iddle-iddle-iddle—
BUM-BUM!"

O' course there's some that likes the tunes
Like "Lilly Dale" an' "Ragtime Coons";
Some like a solo or duet
By Charley Green—B flat cornet—
An' Ernest Brown—th' trombone man.
(An' they can play, er no one can.)
But its the best when Henry Dunn
Lets them there sticks just cut an' run,
An' 'Lijah says to let her hum
With
"Tiddle-iddle-iddle-iddle—
BUM-BUM!"

I don't know why, ner what's the use
O' havin' that to interduce
A tune—but I know, as fer me,
I'd ten times over ruther see
Elijah Plumb chaw with his chin,
A-gettin' ready to begin,
While Henry plays that role o' his
An' makes them drumsticks fairly sizz,
Announcin' music on th' drum
With
"Tiddle-iddle-iddle-iddle—
BUM-BUM!"

DEVICE TO SAVE FIREMEN.

More firemen are killed by falling walls while directing a stream of water into burning buildings than from all other causes combined. A new invention seems destined to make it unnecessary for firemen to expose themselves so much in future. A nozzle has been perfected



Fire Nozzle that Holds Itself.

which will remain in any position in which it is set, and not squirm like a snake as is the case with the old fashioned nozzle. It is known as the Glazier universal nozzle and is not held by jacks, holders or other appliances. It is something radically new to fire fighters.

MARCONI'S LATEST INVENTION.

Marconi has about perfected a system to determine the distance between a ship and the station on shore. This will be carried out by means of an apparatus in the shape of a disc. The vibrations from one apparatus will be felt on the other apparatus disc. The current from fifty miles, says the Canadian Engineer, will naturally be weaker than that from ten miles or still less from five miles. The current will make the disc turn, and the marks at different points will indicate the distance of the ship from the station. Ships will thus be able to locate their exact position, even during the darkest nights or in the thickest fog.

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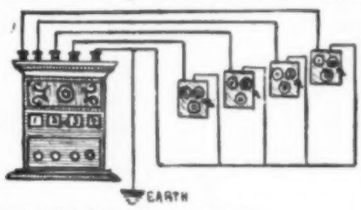

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Device Which Amateur Photographers Will Appreciate.

A developing box large enough to hold the largest size developing tray, and which will rock itself is described by a writer in the Photo-Beacon. The directions are so simple almost anyone can make one. The box is made light-tight and is large enough to hold largest size developing tray to be used. By using running water the box will rock the tray until the water is again shut off. In using I make note of the time when development of negative will be complete, put the tray in the developing box and go about other work until the time arrives when the negative should be developed, then I take it out, rinse the plate and put it in the hypo. The box entirely does away with the necessity of rocking the trays by hand, which is so tiresome when plates develop slowly. I am at liberty to leave and re-enter the darkroom as often as I wish while the developing is going on.

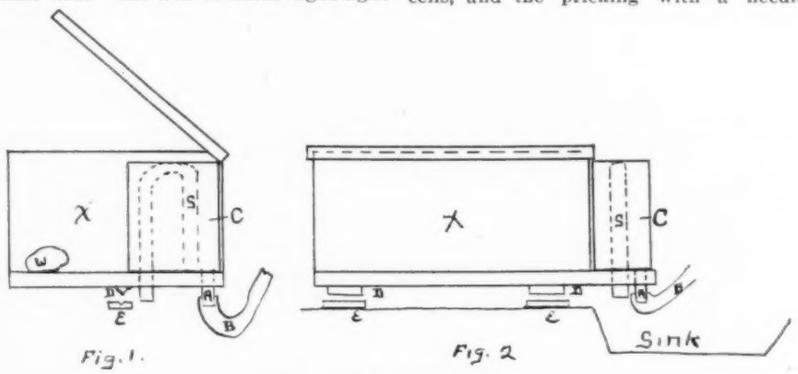

Diagram of the Developing Box.

The box is made of pine and is large enough to hold my largest tray. For a 4 by 5 camera I would make the inside measure 6 by 9 inches, so that two 4 by 5 trays could be put in at one time. The cover is made to fit down tight, so that no light can enter. Box is painted black outside and in. C is a copper box, size 2 by 3 by 4 inches, open at the top. A is a ⅛-inch tube entering one corner of box C from the bottom. Water enters tube A through a rubber tube, B. S is a rubber tube used as a siphon and arranged as shown in Fig. 1. One end projects through the bottom of the box. When box C fills with water the siphon begins to flow and soon empties it. The bore of the siphon should be ¼-inch. D is a pivot on which the box rests, so it can tip back and forth. W is a weight which can be slid back and forth on the shelf until the proper balance is secured. When box C is full, that side of the box is down and W is up. When C is empty, W is down and C is up. But as C is constantly filling and emptying itself, the box is continually rocking. Of course, running water is necessary for its operation.

HOW TO TELL SMALLPOX.

A celebrated doctor tells in the Lancet of an easy way to positively distinguish chickenpox from the much more serious smallpox. In each disease small cells form which fill with matter. In chickenpox these cells are single and the contents will empty by pricking with a needle. In the genuine smallpox the vesicles are made up of numerous small cells, and the pricking with a needle many times will fail to cause the vesicle to completely empty and collapse.

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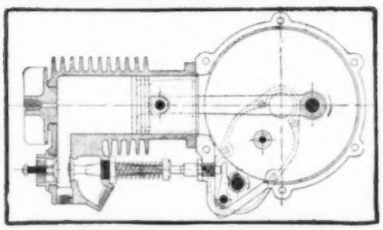

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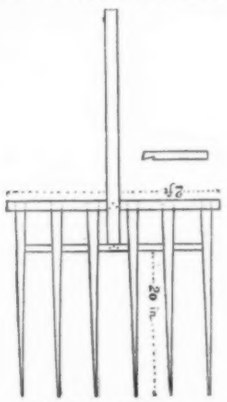
LEITER BUILDING A TOWN.

Two Thousand Men to be Put to Work by the Construction Company.

Joseph Leiter, of wheat fame, is to build a town near Carbondale, Ill., which he is to name Zeigler. The principal commercial resource of the place will be coal. Three coal shafts are now being sunk, 1,000 coke ovens are being built and the Leiter railroad is to be constructed at once. The construction company has asked for the contract for lodging and board for 1,500 men for one year. Fully 2,000 men will be employed for the first year in construction work alone, and after that probably as many more will be put in service.

HOW TO MAKE A HANDY FORK.

A handy fork for handling shredded or cut fodder or chaff of all kinds is shown in the illustration. It is made of 1-2 inch stuff for tines, says the Ohio Farmer. The head is 1 inch square stuff. The piece that goes under the tines to hold the end of handles is ½x1 in. Bore ½-inch holes through head, and round off



Fork for Handling Chaff.

tines to fit, then nail cross-piece on under side of tine so there is 4½ inches space between the two pieces. Then put the handle on over the head and under the crosspiece and nail it. Cut a notch (as in small cut) in end of handle where it goes under crosspiece. The handle is made of a narrow strip of board.

RUSSIAN SOLDIERS MAKE BRIDGES WITH KETTLES.

Perhaps the most remarkable bridges in the world are the kettle bridges in Russia and Siberia, of which Cossack soldiers are expert builders. They are built up of the soldiers' lances and cooking kettles. Seven or eight lances are placed under the handles of a number of kettles and fastened by means of ropes to form a raft. Each of these rafts will bear the weight of half a ton.

BIG SMOKE STACK IN MONTANA.

A gigantic smoke flue is being built at Anaconda, Montana, to remove the fumes from a smelter. It will extend three-quarters of a mile up the steep mountain side and terminate in a stack 200 feet high built on the highest peak. Balloon travellers had better go around some other way.

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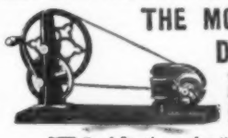

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